Type of Report: Quarterly, July - September 1994.
Alfredo R. Huete, University of Arizona
NAS5-31364

OBJECTIVES

1. Complete data processing and analyses of vegetation index studies for presentation at the IGARSS'94 Symposium, Pasadena California, August 8-12.

2. Revision of ATBD in response to May 1994 peer review.

3. Prepare science data simulation plan for testing of vegetation index algorithms.

4. Prepare for vegetation index presentation at MODIS Science Team meeting plenary session, Oct. 12, 1994.

TASK PROGRESS

1. IGARSS'94 Symposium

The titles of the presentation made at this Symposium were included in the semi-annual report. The following discussion is oriented toward the areas which are of continuing research and development during this quarters activities.

In one paper, the multi-view, bidirectional reflectance profiles of ASAS imagery obtained over Walnut Gulch, Arizona and the OTTER transect in Oregon were analyzed as functions of land cover type, dry vs. wet season, atmospheric condition, and sun angle.

The main objective of this work was to investigate the directional effects of the individual bands and the different VIs calculated from MODIS bands. The strong BRDF signatures of the land cover types wipe out previous assumptions that ratios cancel out topographic and illumination effects. The NDVI was shown to be highly dependent on illumination and topography, while improved versions of the NDVI became much less sensitive. This is an important issue for the VI compositing algorithm development and is currently the subject of much work in this lab. Another surprise was that we found the normalized view angle profiles to show greater sensitivity to external conditions (atmosphere and sun angle) than to vegetation type and the shape of the view angle profile was more a function of the VI used than the vegetation type.

A Landsat TM study of U.S.-Mexico land cover and vegetation differences was also presented with critical examinations of

border differences as seen with the VI. Further work is continuing with this data set by looking at scale effects. The data set has now been converted to 250m and 500m using the MODIS-View simulation provided by MODIS-SDST.

The VIs were also examined by way of the canopy simulation using the Myneni model. This model is being used in on-going work for many purposes, including looking at VI-biophysical parameter relationships for different canopy configurations and for testing VI sensitivities to various vegetation amounts.

2. Vegetation Index ATBD Peer Review

In response to the peer review panel recommendations, an in-depth analysis was made regarding several issues and concerns affecting the performance of the VI. MODIS data will be atmospherically corrected to the best capability. However, the atmospheric correction product remains, at best, at 500km spatial resolution, and relies on dark object asumptions. The 500km resolution product will prohibit correction of residual sub-pixel clouds and thin clouds left from the cloud detection algorithm. This product will also be unable to correct for smoke and localized dust activity. An atmospheric -resistant component within the VI equation, on the other hand, will provide an atmospheric corrected product at 500m resolution and will minimize smoke and residual cloud contamination. The atmospheric-resistant product can be used on both corrected and uncorrected data with minimal effects. This has been tested on several cloud- and smoke- affected Landsat TM images and results have shown the removal of smoke plumes and residual clouds.

In order to improve upon the global' applications and consequences of the VI algorithm, I served on the ISLSCP Initiative 1 CD ROM review. Through this exercise, my lab was able to analyze yearly composited VI products with Fourier based Adjustment, Solar zenith angle correction, Interpolation of missing data and Reconstruction of evergreen broadleaf land cover types' (FASIR) corrections based on land cover type, sun angles, and residual clouds. The applications of the VI and vegetation map products to obtain global estimates of LAI and FAPAR were also critically analyzed. This constructive exercise brought forth many issues which need to be resolved for the MODIS VI product(s).

3. SDST simulation meeting

The meeting at Flathead Lake, Montana was very useful. Wim van Leeuwen from our lab participated. The data dependencies were scrutinized carefully and potential uses of data which can both test the algorithm and software code were discussed. The responsibility for generation of such data sets belong to the team members and not to SDST, however, through the discussions at the meeting it became evident that many data sets can be shared. The dependencies of the VI algorithm to the atmospheric correction, BRDF, DEM, surface reflectance products became evident and a

manner in which these separate algorithms can be linked to the VI implementation is being worked on now.

4. Walnut Gulch AVIRIS data

Karim Batchily (program coordinator) has completed the first phase of processing of the 1991 AVIRIS imagery acquired over Walnut Gulch. He will present his results at the annual meeting, Soil Science Society of America (SSSA) on November 14, 1994. On-going work in this area include simulation of MODIS imagery from AVIRIS, and the use of mixture models to test and validate the VI algorithm.

5. Other activities

I attended an Inter-American Institute (IAI) "Workshop on Comparative Studies of Temperate Terrestrial Ecosystems" on July 26-29, 1994, in Durham, North Carolina. This workshop was hosted by the Inter-American Institute for Global Change Research. This workshop has helped in the development of "test sites" involving comparative North - South temperate land cover type studies for MODIS.

I also attended, by invitation, the "Second Workshop on Spectral Mixture Analysis" on August 15-17, 1994, at the University of Washington in Seattle. The objective of this workshop was to compare state of the art' mixtures methodologies and assess future directions in mixture modeling.

Next Quarter Activities

1. Wim van Leeuwen will attend a HAPEX-Sahel meeting in Toulouse, France on November 14-15, 1994.

2. Dr. Arnon Karnieli of the Ben Gurion University of the Negev, Israel will visit our lab December 12-16, 1994. We have received funding from the International Arid Lands Consortium to investigate the role of microphytic crusts in influencing the VI signal over arid regions. We will design and develop test sites in both Israel and Arizona for this project.

3. Along with Dr. Michel Verstraete of ISPRA, we will convene a joint Hydrology and Atmosphere session on the design and evaluation of spectral Indices at the American Geophysical Union (AGU) meeting in San Francisco, California on Dec. 1994. The objective of the session is to further advance our understanding on empirical global- based approaches toward a biophysical understanding of terrestrial vegetated surfaces.